PRODUCTION FACILITIES

FOR MULTI-TURN METAL-FILM TRIMMER RESISTORS

PER SIGNAL CORPS TECHNICAL REQUIREMENTS SCS-127

Contract Number DA-36-039-SC-86734

Order Number 19056-PP-62-81-81

QUARTERLY PROGRESS REPORT NUMBER 2

FOR THE PERIOD

OCTOBER 1, 1962 THROUGH DECEMBER 31, 1962

UNCLASSIFIED

WESTON INSTRUMENTS DIVISION

PRODUCTION FACILITIES

FOR MULTI-TURN METAL-FILM TRIMMER RESISTORS

PER SIGNAL CORPS TECHNICAL REQUIREMENTS

SCS-127 DATED 9 FEBRUARY, 1962

Contract Number DA-36-039-SC-86734

Order Number 19056-PP-62-81-81

Specification Number MIL-R-22097 B

OBJECT:

To provide production type equipment and tools sufficient to demonstrate the capability of producing 350 units per 8 hour shift conforming to the applicable specifications outlined in the contract.

QUARTERLY PROGRESS REPORT NUMBER 2

FOR THE PERIOD

OCTOBER 1, 1962 THROUGH DECEMBER 31, 1962

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ABSTRACT.

The following outline covers the various phases of work accomplished during the period from October 1, 1962 to December 31, 1962.

A. Assembly and production tooling has proceeded to the point of completion with minor exceptions. All of the preproduction component parts have been received and subjected to incoming quality inspection. These component parts have been assembled into various sub-assemblies using the assembly tooling, and changes improving component quality and facilitating assembly have been proposed.

B. Arrangements have been made with our Quality Acceptance Group to perform the necessary qualification tests; and as an alternative, we have discussed these tests with a Government Approved outside testing company and have received a quotation. The Quality Acceptance Group will also arrange to perform certain acceptance tests requiring unique environmental conditions.

C. A study of the required acceptance tests has been completed and a testing procedure devised. These test procedures have been discussed with our Laboratory Engineering Group and the required test apparatus was decided upon. Work on the test apparatus has

advanced to 33 percent completion and prototype test equipment is being received by Product Engineering.

PURPOSE:

The purpose of Contract DA-36-039-SC-78926 is to:

A. Provide 18 Engineering samples for the purpose of evaluation in the following ranges:

RESISTANCE	QUANTITY	TYPE OF RESISTOR
200 Ohms	6 each	Toroid
50 K Ohms	6 each	Spiral
200 K Ohms	6 each	Spiral

The above samples were submitted accompanied with test data as specified in the contract.

B. Provide 300 Preproduction units for the purpose of evaluating the production tooling and obtain the most suitable assembly procedures prior to the production run. The ranges are as follows:

RESISTANCE	QUANTITY	TYPE OF RESISTOR
200 Ohms	100 each	Toroid
50 K Ohms	100 each	Spiral
200 K Ohms	100 each	Spiral

The preproduction run has been started and the problems encountered are covered in the narrative and data section of this report.

C. Provide 3750 production units in the ranges outlined in the contract. This phase will be performed with production type equipment and production type pilot run necessary to manufacture and test 350 acceptable units per eight (8) hour shift conforming to the applicable specifications as follows:

RESISTANCE	QUANTITY	TYPE OF RESISTOR
200 Ohms	750 each	Toroid
50 K Ohms	750 each	Spiral
200 K Ohms	750 each	Spiral
Lower than 200 Ohms and as low as possible within specifications	750 each	Toroid
Above 200 K Ohms and as high as possible within specifications	750 each	Spiral

The production manufacturing tooling to produce the component parts have been completed except for minor exceptions. The assembly tools for the production type pilot run are approximately 65% completed.

NARRATIVE AND DATA:

Component Parts

The Multi-Turn Metal-Film Trimmer Resistor uses a combination of forty (40) various components of which twenty-three (23) different parts make one complete unit of a toroid or spiral type trimmer. It was decided to sub-contract 31% of the parts to vendors who specialize in a specific phase of manufacturing such as ceramics, cold heading , teflon, moulding, etc. The vendors who are manufacturing the parts were selected on the basis of successful past performance in producing specialized items for Weston.

Operation sheets were written for all parts made at Weston to provide the manufacturing departments with all necessary data for producing the parts within specified tolerances. The Methods Specification sheets furnish information such as: method of operation; type of machine used; tools required, etc. The following are typical examples of operation sheets being used by manufacturing departments to complete a specific part.

METHODS SPECIFICATION

TITLE		SHEETS / SHEET	O. S. No.
CONTACT, WOUND, STRAIGHT LINE TOROID, MODEL 9845	11-9-62 WS:EM	1 / 1	197633

OP. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
05	70-2-301 S/U			
10	WD. CONTACT	.003" dia. Palina #7 Wire		
	1. Wind contact per Dwg. 197633 and check dia. and length.	Pitch tool Coiling point Wire guide		ST-105859 ST-110993 ST-110992
	Machine #3348 Torrington Winder	Gage for length Gage for dia.	53062 53061	ST-0155 ST-99008
20	11-70 INSP	Wire		ND-37538-000
	Inspect (2) package one contact per Glassine envelope	Glassine envelope		SND-28316
	Store in Dept. 777 Faraday Plant.			
	CAUTION: Contacts should be kept clean and handled with nylon gloves.			
		O.S. 197633 Stock Dwg. 197633		

METHODS SPECIFICATION

TITLE		SHEETS	O. S. No.
SLEEVE, ADJUSTER MODEL 9845	11-2-62 HH:SBM 2-5-63 HH:EM	SHEET 1	244504

OPER. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
05	84-3-187 S/U			
10	CENTERLESS GR. Centerless grind to .120 ± .0002 dia. Cinn. Centerless Grinder			
19	84-1-241 S/U			
20	#00 B&S ASM 1. Center and face. 2. Ream .098 dia. 3. Feed to stop 4. Form and cutoff Spindle Speed: 6050 Gears : 40-40 Cycle Time : 5 sec. Gross per Hr.: 120	Feed tube bush. Feed finger Chuck .120 rd. Center & face Center Blade Reamer Bushing Holder Cam set	 R-1049	ST-85899 ST-16110 ST-16109 ST-45047 ST-59457 ST-18259 ST-111615 ST-57205 ST-96411 ST-0126
	NOTE: Slight groove for identification on O.D.	Form tool Cutoff tool Plug gage: .099 No Go	53021	ST-111764 ST-21000 ST-33597
30	84-9-500 CLN - PROC 1A			
31	11-84 INSP			
32	31-7-126 S/U			

METHODS SPECIFICATION

TLE				
SLEEVE, ADJUSTER MODEL 9845	11-2-62 HH:SEM 2-5-63 HH:EM	3 SHEETS SHEET 2	O. S. No. 244504	

OP. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
40	BORE 1. Bore chuck to suit. 2. Bore .1010 +.0002 -.0000 x .065 one end. 3. Remove and place in box. NOTE: Place end with groove in chuck for identification from bored end. Excello Machine	Plug Gage: Go .101 No go .10125		ST-32820 ST-97266
50	REMOVED			
60	REMOVED			
6 70	31-4-178 S/U GR 1. Mount in fixture 2. Grind 660 dim. 3. Remove #000 B&S Grinder	Fixture Plug gage Wheel	53020	ST-111673 ST-33597 In Dept.
7	31-9-990 DEBURR Remove grinding burrs			
8	84-9-501 ULTRC CLN			
90	11-31 INSP			
1	22-2-346 024 FIN - PROC 1			

METHODS SPECIFICATION

TLE		SHEETS	O. S. No.
SLEEVE, ADJUSTER MODEL 9845	11-2-62 HH:SBM	3 SHEET 3	244504

OPER. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
110	22-2-346 077 FIN - PROC 2			
120	11-22 INSP			

METHODS SPECIFICATION

TITLE		O. S. No.
SUPPORT, DRIVER & CONTACT 25 TURNS MODEL 9845	11-2-62 HH:SBM	2 SHEETS SHEET 1 — 244507

OPER. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
09	84-1-241 S/U			
10	#00 B&S ASM	Feed tube bush.		ST-91703
		Feed finger		ST-044
	1. Feed to stop.	Chuck 5/32 rd.		ST-045
	2. Center and face			
	3. Drill	Center & face		ST-45047
	4. Recess	Center		ST-59457
	5. Tap #1-64 NC-2B	Blade		ST-18259
	6. Form and cutoff			
		Drill #53 L.H.		SND-23135
	Spindle Speed: 6050 & 1240	Bushing		ST-56501
	Gears: 40-40	Holder		ST-64763
	Cycle Time: 5 sec.			
	Gross per hr: 720	Recess		ST-99476
		Holder		ST-14202
	NOTE: Check for order on D-244547 same first operation.	Rising block		ST-46674
		Tap #1-64	R-978	ST-0142
	NOTE: Dwg. 244507	Bushing		ST-40184
	Keep cutoff & facing blade sharp, no burrs allowed.	Holder		ST-93234
		Form tool	53017	ST-111670
		Cutoff tool		ST-86417
		Thread Gage: Go & No go		ST-111664
		Cam Set	R-1018	ST-111669
	84-9-500 CLN - PROC 1A			
	31-1-036 TUMBLE Self tumble for 3 hrs.			

METHODS SPECIFICATION

TLE		SHEETS / SHEET	O. S. No.
SUPPORT, DRIVER & CONTACT 25 TURNS MODEL 9845	11-2-62 HH:SBM	2 / 2	244507

OPER. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
30	11-84 INSP			
40	48-01 Ship for flash Nickle and Rhodium Plate 901 Fin.			
50	11-48 INSP			

METHODS SPECIFICATION

M 9845 (TORO D)

	TRIMMER RESISTOR ASSY. STRAIGHT LINE TOROID "VARITRIM" MODEL 9845	1-22-63 CJM:SEM	5 SHEETS SHEET 1	O. S. No. Assem. #1 197602

	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
10	DEPT #53-01 PREPARE CERAMIC TUBING (PER 244505) A. Glaze (Ref. Proc. Spec. 112 Sub 0) 1. Glaze inside, and fire (Refer to O.S.137978) Note: Glaze slip prepared per Proc. Spec. #111 Sub 0 - which is confidential.	Glazing machine Cutoff machine		Mach. #3717 or #3736 Mach. #3457
	B. Cut & Tumble 1. Cut tubing to .650 lengths 2. Tumble to provide .0125 radii both ends & .247 +.002 -.001 3. Clean, ultrasonically.	Tumbling machine Ultrasonic cleaner Metalizing jigs Trent ovens Controller		In dept. In dept. ST-95350 In dept. LA-10513
	C. Apply Band to Ends. Ref. Proc. Spec. #39 Sub 1. Proc. #1 for small lots; Proc. #2 for large lots.	Assembly parts: Tubing ½" long		160510-001
	D. Metalize (Proc. Spec. #38 Sub 3) V-2 Process 1. Load jigs 2. Metalize. Do not touch blanks with naked hand. Note: (1). Vacuum pumps shall be maintained per Proc. Spec. #48 Sub 1			
	Note: (2). Metalizing wire shall be prepared by Spec 113 Sub 0 (Confidential) and drawn per Proc Spec 109 Sub 0			
	E. Age & Check Temp Coefficiency (Ref. EE. Spec 9855 Sub 0) and select for resistance			
20	ASSEMBLE INSULATOR (PER 244551) A. Assem & Rivet 1. Insert insulator in end cap 2. Place bearing in insulator and mount on anvil of riveting device 3. Mount terminal and rivet 4. Place in tray	Rivet P&A #2 S.O.C. Press Soldering Holding Block Solder iron	53009 53010	ST-111654 Mach. # ST-111655 ST-96835
	B. Solder (Per Note #2 on drawing) 1. Place assemblies (10) on solder hold block 2. Solder terminal to bearing & lead wire to terminal 3. Place in tray	Assembly parts: (1) Terminal (1) Bearing (1) Cap (1) Insulator (1) Lead wire		197615-077 197630-001 244201-107 244500-001 244806-001

METHOD SHEET

M 9845 (TORO

NAME HEATER RESISTOR ASSY. STRAIGHT LINE TOROID "VARITRIM" - MODEL 9845	1-22-63 CON:SEI	5 SHEETS SHEET 2	O. S. No. Assem.#1 197602

METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
53- ASSEMBLE ADJUSTER (PER 244550 & 197602)	Manual pressing device	53008	ST-111653
1. Insert adjuster in device 2. Place spring & washer on lead screw & insert to adjuster in device 3. Press lead screw assy. into adjuster to .768 dim., which is controlled by device 4. Remove piece from device and mount end cap 244501 - washer 197606 & bushing 197605-902 as shown per final assy. 197602. 5. Place in shallow sectional tray	Assembly parts: (1) washer (1) spring (1) lead screw (1) adjuster (1) end cap (1) gasket (washer) (1) bushing		197614-07? 197613-001 244549-07? 244503-901 244501-107 197606-001 197605-902
53- ASSEMBLE TERMINAL STRIP (PER 244509)	#1 S.O.C. Press		
A. Rivet 1. Place (3) pins in nests of anvil	Punch & anvil (alt.) 53064 Tweezers		ST-111651 ST-81287
2. Mount strip onto pins 3. Mount terminal onto protruding pin, clamp in place and rivet 4. Slide anvil to next pos. and repeat as in #3 above 5. Repeat for third term. as in No.4 above	Assembly parts: (3) pins (2) end terms. (1) center " (1) strip		244503-107 197626-07? 197625-07? 197627-001
B. Solder 1. Place strip assy. in holding fixture & solder terminals to pins per Note 1 & 2 on drawing. Bend center terminal up per drawing. 2. Remove from fixture and aside to tray	Holding & solder fixture Solder iron 37½ watt tip 23 watt tip Cross tip for above tips - as an alternate use Solder iron 25 watt	53002	ST-111647 ST-78642 SND-38849 SND-38848 ST-37253 ST-91474

METHOD SPECIFICATION M.9815 (TORO)

TRIMMER RESISTOR ASSY. STRAIGHT LINE WOUND "VARITRIM" - MODEL 9815 | 1-22-63 COM:SEM | SHEETS SHEET 3 | O. S. No. Assem.#1 197602

	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
50	ASSEMBLE END CAPS (PER 197602)			
	A. Assem. Follower (per 244548)	Holding fixture	53033	ST-111684
	1. Mount adjuster assy. from Oper. #30 in holding fixture	Tweezers		ST-17271
	2. Thread contact follower onto lead screw			
	3. Manually interlock contact spring and mount in groove of follower			
	B. Mount Insulator to Tube (Per 197602)			
	1. Place insulator assembly from Oper. #20 into nest of device. Close tube guide and drop tube into place	Pressing device	53001	ST-111646
	2. Press tube into end cap of insulator assy.			
	3. Open guide and remove piece			
	C. Mount Adjuster			
	1. Mount washer & spring to lead screw (Hold in fixture ST-111684)	Holding fixture		ST-111684
	2. Mount tube & insulator assy. over the contact follower with a rotary motion and push tube into end cap on adjuster assy. until the end of the lead screw enters the bearings in the insulator	Press device Torque screwdriver. Clutch type. preset (air draulic)		ST-111646 ST-101778
	3. Remove piece from holding device & place in pressing device as in Oper. #30B & press adjuster end cap onto tube until correct torque to rotate adjuster is obtained (10 in/oz)	Assembly parts: Adjuster (Oper. #30) Insulator (Oper. #20) Contact (Per 244548) Follower (Per 244548) Tube (Oper #10)		244550-901 244551-901 197633-001 244547-901 244505-001
53	MOUNT & SOLDER STRIP (PER 197602)			
	1. Place term. strip assy. (from Oper. #40) in holding fixture ST-111647 & solder lead wire from insulator to center tap terminal.	Holding & solder fixture Solder iron	53002	ST-111647 ST-96835
	2. Insert body of unit into (2) end terminals, locate & clamp in place. Refer to Note 2 on drawing			
	3. Solder end caps to term. board end terminals per note 1, 2, & 6.			
	4. Unclamp and remove piece and pass to inspection.			

METHOD SPECIFICATION M.9845 (TOROID)

TRIMMER RESISTOR ASSY. STRAIGHT LINE TOROID "VARITRIM" - MODEL 9845	1-22-63 CON:SEM	SHEETS 5 SHEET 4	C. S. No. Assem.#1 197602

OP. NO.	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
10	10-53 INSPECT Inspect prior to encapsulation, per Inspection Procedure for Varitrim - Model 9845. 100% Inspection.	Torque screwdriver -or- Torque screwdriver		ST-111203 ST-87307
30	53-01 ENCAPSULATE (PER 197602 & PROC SPEC #36) 1. Place (12) units in mold cavities 2. Close & mold (during mold cycle load other molds) 3. Open mold, remove pieces & place in trays for post-mold cure. 4. Place units in oven and bake for (3) hours at 284° Fahr. 5. Remove and cool.	Hull molding press semi-auto (12) cavity mold	53000	ST-111645
5	REMOVE FLASH 1. Place units in degating device & shear off flash. 2. Place in trays	Degating device	53011	ST-111656
100	10-53 INSPECT Inspect per Group "A" Mil Spec #22097-B Table 5. 100% Inspection.	Proto type Test fixt. Contact res. test set as below: (1)Power supply (1)Oscilliscope (1)Fixture End & total res. test device as follows: (1)Imp. Comparator (1)Decade res. (1)Fixture	T-58007 58008 " " T.58000 " "	LA-12659 LA-12660 LA-12661 LA-12656 LA-12657 LA-12658

Torque Watch M. 9845

METHODS SPECIFICATION

M.9845 (TOROID)

	TRIMMER RESISTOR ASSY. STRAIGHT LINE TOROID "VARITRIM" - MODEL 9845	1-22-63 CGM:SEM	SHEETS SHEET 5	O. E. No. Assem. #1 197602
	METHOD OF OPERATION	TOOLS & MISC. SUPPLIES	TOOL ORDER NO.	DWG. NO. N. D. NO. S. T. NO.
0	53-01 STAMP (PER 197602) 1. Set unit in guide device & stamp 2. Set aside to dry 3. Stamp opposite side	Stamp guide fixture Stamps Ink	53003 R.2043	ST-111648 SND-29738
0	53-03 INSPECT (PER 197602 & PER ORDER) Final inspect & approval per inspection procedure for "Varitrim" - Model 9845	Refer to Oper. #100 for equipment.		
0	53-01 PACKAGE	M.9845 Toroid Assem. #1 197602-901		Trimmer Resistc Detail dwgs. 244505 Tube 244551 Insul. 244550 Adj. Sc 244509 Term. St Assy 244548 Follow

Preproduction Sample Parts:

All sample parts were received for use in our preproduction run of 300 units per contract specifications. We have encountered difficulties with some parts in our sub-assembly operations and have taken corrective action before proceeding with the final production run of manufactured parts. Some of the difficulties were:

Trimmer Molded:

Our drawing indicated a .145" dia. X .020" deep recess at the head adjuster end of the Resistor, to make certain the head adjuster moves freely after epoxy molding. A prototype single cavity mold was made, eliminating this recess, and it was found that no binding occurs after molding. This will help facilitate the making of a multi-cavity mold and will offer a better epoxy seal around the adjuster. We also added a bead of epoxy around the outer edges of each end cap assembly at the teflon insulator. This will help locate the angular position of the terminal, prevent molding pressure from compressing the teflon bushing on terminal end and thus shifting the contact path on the film strip, and also prevent seepage of epoxy into the assembly during the mold cycle.

Wound Contact:

It was originally planned to produce a contact with 90 to 92 turns in a .370" length, however, at visual inspection the openings

between turns appeared excessive. This was revised to obtain 120 to 126 turns within the specified length to offer more contact points.

Lead Screw Spiral Type:

The spiral type resistor is designed with a rigid lead screw, allowing the follower to move freely along the metallized path of the ceramic tube. The lead screw is positioned by soldering it to the end cap assembly. We encountered some difficulty obtaining a consistent solder joint and found that in some instances the lead screw would disengage by finger pressure. This was corrected by increasing the length of the lead screw .040" at the solder joint end to obtain additional surface for soldering the two components together.

Header Assembly:

This unit consists of three parts: the adjuster head, bushing insert, and molded teflon material in which the two parts are bonded. The sub-contractor encountered some difficulty in molding the teflon over the head and insert because of a burr at the slot end of the adjuster head. The mold is constructed using the slotted end of the head as a locating point. Corrective action was taken by adding a tumbling operation to remove the burr and thus insure proper seating of the part in the mold cavities.

Sleeve Adjuster:

Due to the symmetry of this part, it was difficult to detect which end of the sleeve is bored to fit the header assembly without trial and error or close visual inspection. This will be overcome in the production run by adding a groove mark on one side to facilitate assembly.

Support Driver Contact:

We were successful in procuring extruded stock per specifications to eliminate secondary milling operations and thus finish the part accurately in one machine operation. A small burr formed on the inside of the slot at the cut-off station of the screw machine operation, and thus prevented the contact spiral element from seating properly in the slot. This will be corrected by tumbling the part to remove all burrs prior to plating.

Lead Screw Toroid Type:

This part is pressed to the header assembly in one of the subassembly operations. Both ends of the lead screw are similar, therefore, it was difficult to visually denote which end is pressed into position. A small countersink was added on the end of the lead screw pressed into position to facilitate the assembly operation.

Resistance Blanks:

A range of resistance blanks was made in accordance with the theoretical formula devised by Product Engineering. The blanks were then spiralled by Product Engineering using the Research and Development facilities. The data taken for the 25 turn spiralled blanks verifies the validity of the theoretical formula. No conclusion can be made for the 10 turn spiralled blanks, since it was discovered while spiralling that the particular range of resistance blanks used had defective resistance films.

It will be recalled from Quarterly Report No. 1, Page 10, that for the 25 turn unit the theoretical formula is given by:

$R_f = C N R_b + R_b$ Where R_f = Final Resistance (ohms)

R_b = Blank Resistance (ohms)

N = Number of Spirals

C = 31

This formula was solved for C.

$$C = \frac{R_f - R_b}{R_b N}$$

The experimental data obtained from spiralling resistance blanks having theoretically predicted nominal values of 25 turns, 50 K

Ohms and 25 turns, 200 K ohms was inserted in the preceding expression for C. Four groups of approximately 10 blanks each were used to compile the following data.

Group	Nominal Resistance	Nominal Turns	Average C
1	50 K Ohms	25	28.77
2	50 K Ohms	25	30.9
3	50 K Ohms	25	29.5
4	200 K Ohms	25	33.38
			30.6 Average

Note that the experimental average of C = 30.6 deviates only slightly from the theoretical value of C = 31. Some slight deviation is to be expected due to the finite, slightly variable width of the actual spiral cut.

Inspection Procedures:

An Inspection and Quality Control Plan Manual is being prepared and will be completed prior to the production run of the Trimmer Resistor. This manual describes the in-process and final inspection of a completed unit, as well as quality control techniques used in the production of the individual parts and sub-assemblies.

The instrument or equipment that will be used for the various tests, such as total and end resistance, contact resistance variation, rotational life, etc., will be specified for each inspection station.

The manufactured parts, either made at Weston or purchased, are being inspected per AQL specifications. The Inspection Department has been provided with Inspection Procedure Data Sheets for checking the individual parts. Typical examples of completed inspection procedure sheets for parts manufactured at Weston or purchased are enclosed on the following pages.

INSPECTION PROCEDURE NO.- 4028

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION CONTACT, SPIRAL ELEMENT MODEL 9845 CL- D D- 197611

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DeRing DATE 1-23-63 APPROVED BY C. Geyer DATE 1/23/63

SHEET 1 OF 2 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
				INSPECT AS PURCHASED		
1	201	Min	1.5	Angle of longest tabs (2)	85° + 5°	Optical Comp. in Dept 11-31 is to be used for all dimensional checks. Use the rotating fixture and stand the piece upright with the tabs resting on the rotating fixture.
2	202	Min	1.5	Angle of bend on end of tabs (2)	45° ± 5°	
3	203	Min	1.5	Length of tabs (2)	.050" ± .005"	
4	204	Min	1.5	Length of tab ends (2)	.010" ± .005"	
5	205	Min	1.5	Radius at bend (2)	.010" ± .003"	
6	206	Min	1.5	Height of top boss	.0055" Min.	
7	207	Min	1.5	Dimension between tangent points (2)	.030" + .005" - .000	
8	208	Min	1.5	Length of top boss	.025" ± .003"	
			NOTE:	Turn the rotating fixture and part 90° and check the following:		
9	209	Min	1.5	Angle of tabs (2)	45° ± 5°	
10	210	Min	1.5	Width of top boss	.015" ± .003"	

INSPECTION PROCEDURE

NO.- 4028

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION CONTACT, SPIRAL ELEMENT MODEL 9845 CL- D D- 197611

PREV. D-

NEXT D-

ISSUE NO. 1 C/D CHANGE

PREPARED BY W. DeRing DATE 1-23-63 APPROVED BY [signature] DATE 1/24/63

SHEET 2 OF 2 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
11	211	Min	1.5	Angle of top boss	2° 45' ± ½°	
12	212	Min	1.5	Heat treat	per print	L.A.T.
13	213	Min	1.5	Burrs	None allowed	Visual

INSPECTION PROCEDURE

NO.- 4012

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION INSERT, MOLDED ADJ. MODEL 9845 CL- A D- 197623

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DeRing DATE 12-12-62 APPROVED BY C. [signature] DATE

SHEET 1 OF 1 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
				INSPECT AFTER OPERATION 50 IN DEPT 84		
1	101	Maj.	.65	Diameter	.1500" ± .0002"	Micrometer
2	201	Min	1.5	Width across flats	.120" ± .003"	Micrometer
3	202	Min	1.5	Diameter	.120" ± .003"	Micrometer
4	102	Maj	.65	Diameter	.1014" + .0002" - .0000	Micrometer
5	103	Maj	.65	Length	.050" + .000" - .003"	Height gage
6	104	Maj	.65	Length	.070" ± .003"	Height gage
7	105	Maj	.65	Length	.100" + .000" - .003"	Height gage
8	106	Maj	.65	Depth of hole	.075" ± .002"	Height gage & appropriate pin
9	107	Maj	.65	Depth of C/bore	.025" + .000" - .002"	Height gage
10	108	Maj	.65	Hole diameter	.038" + .0002" - .0000	Plug gage ST 110285
11	109	Maj	.65	Diameter of C/bore	.076" ± .003"	Plug gage Go - ST 53826 NoGo-ST 30435
12	203	Min	1.5	Cut-off burr	None permitted	Visual
13	204	Min	1.5	Head not broken through by drill	--- ---	Visual
14	205	Min	1.5	Chamfer	45° ± 5°	Comparator
15	206	Min	1.5	Chamfer	.003" x 45° ± .003" ± 5°	Comparator

M.9302

INSPECTION PROCEDURE

NO.- 4024

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION STRIP, TERMINAL CL- A D- 197627

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DeRing DATE 1-23-63 APPROVED BY [signature] DATE 1/23/63

SHEET 1 OF 2 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
				INSPECT AS PURCHASED		
1	201	Min	1.5	Material	.020" ± .004" Formica	Micrometer & Visual
2	202	Min	1.5	Length	.792" ± .005"	Micrometer
3	203	Min	1.5	Width	.187" ± .005"	Micrometer
4	101	Maj	.65	Hole diameter (3)	.032" + .000 - .001"	Plug Gage ST 59954
5	204	Min	1.5	Distance between C/L's of 2 -.032" holes (length)	.700" ± .002"	Center-micro
6	205	Min	1.5	Length of elongated holes	.180" ± .005"	Opt. Comp or Mauser
7	206	Min	1.5	Width of elongated holes	.062" ± .005"	Opt. Comp or Plug Gage GO - ST40981 NoGo-ST52434
8	207	Min	1.5	C/L of .032" hole to end of lst elongated hole	.110" ± .005"	Opt Comp
9	208	Min	1.5	C/L distance between two (2) .032" Holes	.400" ± .002"	Opt. Comp

INSPECTION PROCEDURE NO.- 4024

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION STRIP, TERMINAL CL- A D- 197627

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DeRing DATE 1-23-63 APPROVED BY [illegible] DATE 1/23/63

SHEET 2 OF 2 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
10	209	Min	1.5	C/L of .032" hole to end of 2nd elongated hole	.460" ± .005"	Opt. Comp
11	210	Min	1.5	Location of two .032" holes from edge.	.043" ± .005"	Opt. Comp
12	211	Min	1.5	Location of two elongated holes from edge	.093" ± .005"	Opt. Comp
13	212	Min	1.5	Location of bottom .032" holes from upper .032" holes	.100" ± .002"	Opt. Comp
14	213	Min	1.5	Angle (2)	45° ± 3°	Opt. Comp
15	214	Min	1.5	Radii (4)	.046" ± .005"	Opt. Comp
16	215	Min	1.5	Miscellaneous: Must not be cracked, broken or chipped.		Visual

INSPECTION PROCEDURE

NO.- 4011

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION SLEEVE, ADJUSTER CL- B D- 244504

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DERING DATE 12-12-62 APPROVED BY [signature] DATE

SHEET 1 OF 1 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
				INSPECT AFTER OPERATION 50 IN DEPT 84		
1	101	Maj	.65	Outside diameter	.120" + .002" - .000	Micrometer
2	201	Min	1.5	Length	.760" ± .000 - .005"	Micrometer
3	102	Maj	.65	Inside diameter	.100" + .000 - .002"	Plug gage Go - ST 80098 NoGo-ST 51460
4	103	Maj	.65	Inside diameter	.101" + .0002" - .0000	Plug gage Go - ST 32820 NoGo-ST 97266 (Use Go End)
5	202	Min	1.5	Depth	.065" ± .005"	Height gage & appropriate plug gage
				INSPECT AFTER OPERATION 80 IN DEPT 84		
1	201	Min	1.5	Length of slot	.660" ± .005"	Vernier
2	101	Maj	.65	Depth of ground slot	.036" + .000 - .002"	Height gage
3.	102	Maj	.65	Location of slot from end	.050" + .005" - .000	Micrometer
4	202	Min	1.5	Deburred	Burrs removed	Visual
				INSPECT AFTER OPERATION 110 IN DEPT 22		
1	101	Maj	.65	Plating	077 Proc 2 after 024 Proc 1	Visual

FM-2302

INSPECTION PROCEDURE

NO.- 4014

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION SUPPORT, DRIVER & CONTACT MODEL 9845 CL- A D- 244507

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DeRing DATE 12-12-62 APPROVED BY DATE

SHEET 1 OF 1 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
				INSPECT AFTER OPERATION 20 IN DEPT 84		
1	101	Maj	.65	Length	.100" ± .002"	Micrometer
2	102	Maj	.65	Diameter	.150" ± .002"	Micrometer
3	103	Maj	.65	Slot width (2)	.034" + .002" - .000	Gage blocks
4	104	Maj	.65	Location of slot from end	.050" ± .001"	Height gage & gage block or comparator
5	105	Maj	.65	Thread	# 1 - 64 NC 2B	Plug th'd gage ST 111664
6	106	Maj	.65	Radius	.055" + .002" - .000	Thread gage "V" block & height gage
7	107	Maj	.65	Radius	.046" + .002" - .000	Thread gage "V" block & height gage
8	108	Maj	.65	Location of slot from C/L	.055" ± .002"	Thread gage "V" block & height gage
9	109	Maj	.65	Location of flats from C/L	.022" + .002" - .000	Comparator
10	201	Min	1.5	Burrs	To be free of burrs	Visual
				INSPECT AFTER OPERATION 40 IN DEPT 48		
1	201	Min	1.5	Finish	Flash nickle and Rhodium plate	L.A.T.

FM-2302

INSPECTION PROCEDURE

NO.- 4029

WESTON INSTRUMENTS, DIVISION OF DAYSTROM, INC.

DESCRIPTION INSULATOR ASS'Y MODEL 9845 CL- B D- 244551

PREV. D-

ISSUE NO. 1 C/D CHANGE NEXT D-

PREPARED BY W. DeRing DATE 1-23-63 APPROVED BY C. [illegible] DATE 1/23/63

SHEET 1 OF 1 SHEETS APPROVED BY DATE

SEQ. NO.	C/D NO.	CLASS	% AQL.	CHARACTERISTIC	SPECIFICATION	METHOD
				INSPECT AFTER OPERATION 20 OF METHOD SPECIFICATION FOR ASS'Y 197602		
1	201	Min	1.5	Assembly	Must have the following parts: 1 End Cap 244501 1 Insulator 244500 1 Bearing 197630 1 Terminal 197615 1 Lead Wire 244806	Visual
2	202	Min	1.5	Rivet soldered to terminal	per print	Visual
3	203	Min	1.5	Lead soldered to terminal lug	per pring	Visual (Solder should have a fillet from the terminal to the wire. The wire must be free of nicks or cut strands and insulation must not enter the solder).

Sub-Assembly Tooling:

Lead Screw Assembly - Spiral Type

A manual collet type fixture was designed to position the lead screw and end cap assembly prior to soldering.

The initial soldering fixture as designed did not position the lead screw precisely in a vertical position. A revision is being made to attain positive positioning by providing a locating hole in the vertical stop of the fixture.

Strip Terminal Assembly

We designed and made a fixture to simultaneously stake the three terminals to the formica wafer using an Air Press. Due to the nature and size of the parts involved, we could not consistently obtain a good mechanical stake at all three positions. This fixture was redesigned to stake one terminal at a time using a sliding type fixture to position the part under the staking tool.

End Cap Assembly

The operation of pressing the end cap assemblies onto the spiralled tube was to be performed with a positioning fixture mounted in a manual type housing. This was a cumbersome operating tool during the sample run and

would be impractical for production runs. We will mount the positioning fixture in a precision Pneumatic Press that has variable control ram travel and micrometer stop depth control that will provide repeat tolerances to meet our specifications.

End Cap Assembly - Toroid Type

A small inexpensive multi-holding block was made to hold the end cap assembly while soldering the end bearing and the wire lead to the terminal. Although this fixture performed satisfactorily during the sample run, it is a little awkward to use for production purposes and will be replaced with a rotary type fixture that will facilitate this operation.

Adjuster Assembly - Toroid Type

A manual type fixture was designed and fabricated to press and position the lead screw in the adjuster head assembly to the correct length per drawing specifications. The fixture was producing inconsistent subassemblies on the sample run and will be redesigned to obtain positive positioning in the fixture instead of relying on a screw stop.

TEST EQUIPMENT:

Qualification Tests:

The qualification tests per MIL-R-22097B will be either performed by our Quality Acceptance Laboratory, or will be contracted out to a Government Approved testing organization at the discretion of Quality Acceptance. All necessary test equipment is available to Quality Acceptance, and the specialized fixturing is either available or in the process of being fabricated.

Acceptance Tests:

The acceptance tests per MIL-R-22097B have been segregated into the following categories:

1. General - Tests that are performed repeatedly during environmental or miscellaneous tests, i.e., total resistance, setting stability, etc.
2. Environmental - Tests that require unique environmental conditions, i.e., shock, acceleration, etc.
3. Miscellaneous - Tests that fall in neither the general nor environmental test categories, i.e., solderability, etc.

The above categorizing of tests was done in order to minimize

design duplication, since a given general test apparatus can be used in more than one environmental or miscellaneous test, as well as the general test per se.

The acceptance tests will be performed by either Quality Control personnel at the product assembly site or by the Quality Acceptance Laboratory, depending upon the nature of the test. For instance, the environmental and miscellaneous tests which require highly specialized equipment will be performed by the Quality Acceptance Laboratory using the same fixturing that will be used for the qualification tests. The test equipment and fixturing for the acceptance tests performed by the Quality Control Group is being furnished by the Laboratory Engineering Group. The following tables are breakdowns of the acceptance tests, covering the salient points made self-explanatory by the table headings:

GENERAL TESTS:

Test Title	MIL-R-22097 B Par.	Grp.	Performed By	Equipment Provided For Q.C. Testing by Laboratory Engineering Pre-Manufactured: Description	Tool #	Special Fixturing: Description	Tool #	Qty
Total Resistance End Resistance	4.6.2.1 4.6.2.2	A	QC	Impedance Comparator Decade Resistor Box	T58006	Connector (T58007) Rotary Apparatus Switching Arrangement	T58006	1
Effective Electrical travel & linearity	4.6.3	B1	QC	Chart Recorder Voltage Supply	T58011	" "	T58011	1
Contact Resistance Variation	4.6.4	A	QC	Oscilloscope Current Supply Decade Resistor Box	T58008	" "	T58008	1
Dielectric: MIL-STD-202-301,105C Atmospheric Barometric	4.6.5.1 4.6.5.2	A B1	QC QC	Meg Pot	Presently Available	--Multiposition test -board with switching arrangement and vacuum equipment	T58009	1
Insulation Resistance MIL-STD-202-302	4.6.6	B1	QC					
Clutch & Torque	4.6.7	B1	QC					

QC = Quality Control
QA = Quality Acceptance

ENVIRONMENTAL TESTS:

Test Title	MIL-R-22097 B		MIL-STD 202B	Associated General Tests	Performed By	Equipment Provided For Q.C. Testing By Laboratory Engineering				
						Pre-Manufactured:		Special Fixturing:		
	Par.	Grp.				Description	Tool#	Description	Tool#	Qty
Thermal Shock	4.6.8	B1	107A-B	Setting Stability Total Resistance	QC	Cycling Cabinets	Available T 58012	Multi-position board switching arrangement	T-58012	1
Resistance - Temperature characteristic	4.6.9	C1	304	Total Resistance	QA					
Moisture Resistance	4.6.10	C1	106	Total Resistance Insulation Resistance						
Acceleration	4.6.11	C1	-	Total Resistance setting stability						
Shock, medium Impact	4.6.12	C1	205							
Vibration, high Frequency	4.6.13	C1	204							
Salt Spray	4.6.14	C1	101A	-						

CONTINUED -

Environmental Tests: CONTINUED -

Test Title	MIL-R-22097 B		MIL-STD 202B	Associated General Tests	Performed By
	Par.	Grp.			
Low Temperature	4.6.17	C2	-	Total Resistance setting stability torque	QA
High Temperature	4.6.18	C2	-	Total Resistance setting stability torque. Dielectric Atmos. Insulation Resistance	QA

MISCELLANEOUS TESTS:

Test Title	MIL-R-22097 B Par.	Grp.	MIL-STD 202B	Associated General Tests	Performed By	Equipment Provided for Q.C. Testing By Laboratory Engineering — Pre-Manufactured: Description	Tool#	Special Fixturing: Description	Tool#	Qty
Life	4.6.16	C2	108	Total Resistance Setting Stability Dielectric atmos. torque	QA					
Rotational Life	4.6.19	C2	-	Total Resistance	QC	Voltage supply	T58010	6 Position Fixture Rotary cycling equipment	T58010	1
Terminal Bending	4.6.20.2	C2	-	None	QC	Equipment Presently Available				
Terminal Loading	4.6.20.1	C2	-							
Terminal Solder	4.6.21	B2	208							
Effect of Solder	4.6.15	C2	-	Total Resistance	QA					
Immersion	4.6.22	B2	-	None	QC	Equipment Presently Available				

CONCLUSIONS:

As a result of the work performed during the period of October 1, 1962 to December 31, 1962, the following summations are made:

1. The pre-production run of parts used to produce sub-assemblies necessitated some drawing changes, however, the revisions were mainly to facilitate and improve quality. These changes will not alter the capacity of the Trimmer Resistor to meet or exceed the requirements of MIL-R-22097B.

2. The test procedures have been developed and the test equipment is in the process of fabrication.

3. The Inspection and Quality Control Plan outlining the in-process and final inspection procedures of the Trimmer Resistor is approximately 80% completed and will be finished within the next reporting period.

4. The Quality Acceptance Tests as outlined in Mil Spec 22097B have been developed by the contractor and a Government Approved sub-contractor, and either or both sources are available to meet the contract commitments.

5. The work development and performance indicates that the

schedule as outlined in the U. S. Signal Corps contract No. DA-36-039-SC-86734 will be held.

It is estimated that 25% of the overall program has been completed. The task of inspecting and testing component parts before proceeding with final production runs, the testing and revising of assembly tools, and the final development work of the acceptance and quality tests will now enable us to actually start production on the Trimmer to the accorded specifications.

PROGRAM FOR THE NEXT QUARTER:

1. Issue all work orders to produce sufficient amount of component parts to complete the final production run per contract DA-36-039-SC-86734.

2. Use of production tooling incorporating all tool revisions for starting the production run of 300 pre-production units per contract specifications.

3. Final installation of the pilot line in a totally enclosed area.

4. Completion and tryout of all test equipment furnished by the Laboratory Engineering Group.

PUBLICATIONS AND REPORTS:

There were no technical articles published during this reporting period.

CONFERENCES:

There were no conferences held during this reporting period.

BACKGROUND OF ADDITIONAL PERSONNEL

WORKING ON PROJECT:

VAUGHN F. PIERSON

Mr. Pierson has been with Weston since 1953 in various engineering capacities. Product improvement and cost reduction were typical Product Engineering assignments. While a Project Engineer in the Thermometry Research and Development Section, he assisted in the development of the Ruggedized High-Shock Thermometers now in use on our atomic submarine fleet.

His experience includes project assignments in the development group assigned to metal film applications, where fields of interest include fixed resistors, trimmer resistors and large variable potentiometers. Mr. Pierson holds a M. E. degree from Stevens Institute of Technology and M. S. from Newark College of Engineering. He is currently with the product group covering metal film resistors.

ROBERT PAUL:

Since joining Weston in 1956, Mr. Paul has undertaken various assignments in the Chemical Engineering section as a Technician.

His functions included varied jobs, such as: work on organic and inorganic finishes of paints, electro-plating, plastisols, etc., development of anti-static solution for plastics commercially know as "Statnul", and helped establish laboratory acceptance tests for checking electrical instruments.

Mr. Paul has been assigned to the Product Engineering group for the past three years, covering metal film applications. One of his functions is the responsibility of applying the metal film to the inner diameter of the tubular substrate per desired specifications.

JAMES P. KEELEN

Mr. Keelen has been employed by Weston for the past eleven (11) years with extensive experience in quality control and inspection procedures. His responsibilities covered a broad area of activity in instrumentation of all types, as well as metal film resistor process control systems.

Mr. Keelen has attended special courses in the statistical quality control and instrumentation field at Newark College of Engineering and Rutgers University. He is currently the Department Head of the Quality Control and Inspection Section concerned with metal film resistors, and is directly responsible

for preparing the Inspection Manual for the Rectlinear Film Resistor.

TOTAL HOURS WORKED BY KEY PERSONNEL:

NAME	TITLE	HOURS WORKED THIS REPORTING PERIOD
Herman J. Schmitz, Jr.	Manager-Product Eng.	60
Robert J. Lender	Chief Engineer	45
Joseph Bebel	Section Chief	60
Philip G. Cobb	Section Chief	65
Frank V. Effenberger	Project Engineer	490
Chester S. Kuduk	Project Engineer	480
Vaughn F. Pierson	Product Engineer	70
Robert Paul	Technician	300
James P. Keelen	Dept. Head Quality Control	80
		1650

WESTON INSTRUMENTS DIVISION

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